4070-317 CIP

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re United States Patent Application of:		**Docket No.:**	**4070-317CIP**
Applicant:	**Jose I. Arno et al.**	**Examiner:**	**N.M. Nguyen**
Application No.:	**09/212,107**	**Art Group:**	**1754**
Date Filed:	**December 15, 1998**	**Confirmation No.**	**8874**
Title:	**APPARATUS AND METHOD FOR POINT-OF-USE TREATMENT OF EFFLUENT GAS STREAMS**		

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CERTIFICATE OF FACSIMILE TRANSMISSION

I hereby certify that I am Facsimile transmitting the attached documents to the U.S. Patent & Trademark Office on the date specified, to Facsimile No. 703-872-9311 under the provisions of 37 CFR 1.6 to the Commissioner of Patents, P.O. Box 1450, Alexandria, VA 22313-1450, Mail Stop RCE.

Lee Ann DiLello

Lee Ann DiLello

October 1, 2003
Date

703-872-9311
Facsimile Number

DECLARATION OF JOSEPH D. SWEENEY IN U.S. PATENT APPLICATION NO. 09/212,107

Commissioner for Patents
Mail Stop RCE
P. O. Box 1450
Alexandria, VA 22313-1450

Sir:

I, Joseph D. Sween y, hereby declare:

1. THAT I am a named co-inventor of the invention that is described and claimed in U.S. Patent Application No. 09/212,107 filed in the United States Patent and Trademark Office on December 15, 1998 in the names of Jose I. Arno, Mark Holst, Sam Yee, Joseph D. Sweeney, Jeff Lorelli and Jason Deseve for "APPARATUS AND METHOD FOR POINT-OF-USE TREATMENT OF EFFLUENT GAS STREAMS" (the "Application").

2. THAT I am familiar with the Official Action and rejection from the U.S. Patent and Trademark Office dated June 3, 2003 in which claims 21, 26-27, 51-54, 57-58 and 61 were rejected. Further I am familiar with the references cited by the Examiner including Knapp et al. (US Patent 6,019,818), Dahlstrom et al. (US Patent 4,147,756) and Macedo et al. (US Patent 5,405,590).

3. THAT the invention of the Application relates to an abatement system that comprises a first scrubbing unit wherein the effluent gas is flowed co-currently with a scrubbing liquid to remove gases and solids. From the first stage scrubber unit, the partially treated gas flows to a second stage scrubber unit. The second scrubbing unit has a smaller diameter than the first stage scrubber unit.

4. THAT we have shown that the smaller size of the second scrubbing unit, due to the smaller volume constraints, enables proper wetting with a lower water flow rate. Further, the efficiency of the two-stage scrubber is high and allows the system to operate without using chemical injection agents and/or large amounts of fresh water.

5. THAT Knapp et al. (US Patent 6,019,818) describes a single system for the purpose of quenching and scrubbing a hot gas stream. Of particular importance is the description of a design for reducing heat damage and/or corrosion to the "hot-cool interface" (HCI). The patent mentions that a second absorption column could be used to further reduce the concentration of target effluent species. However, no mention is made regarding the design specifics of the secondary column (i.e. size, scrubbing liquor, packing media). The difficulty is determining a design that does not add to the required installation space, that does not require additional scrubbing liquor, and that does not significantly add cost to the unit. An unexpected result of our invention is that, compared to a single absorption column, less fresh water flow (make-up water) is required to effect superior and surprisingly better contaminant removal efficiency.

6. THAT we have preformed tests to show that a secondary column having a smaller diameter relative to that of a secondary column with a larger diameter is unexpectedly more efficient. The scrubbing liquor is fresh water free of contaminants. Therefore, the last thing that the effluent gas stream sees prior to leaving the scrubber is fresh water. Not only does this situation promote the best possible mass transfer driving force, it also avoids the efficiency limits associated with recirculating a contaminated solution such as

disclosed in Dahlstrom et al. (US Patent 4,147,756) and Macedo et al. (US Patent 5,405,590).

Dahlstrom describes the treatment of effluent containing chloride and SO_2 components. It is a dual column absorption system in which the first column is used to treat chlorides and the second larger unit is used to treat SO_2. Further, Dahlstrom requires the use of a chemical injection agent in the secondary column and because of the size of the second column, Dahlstrom calls for large amounts of scrubbing liquids.

Macedo, as with Dahlstrom et al., uses a much larger secondary column. We have found that this is not necessary, and choosing a secondary column that is too large will have the deleterious, and we found the, non-intuitive effect of leaving much of the packing material underwetted thereby resulting in poor absorption efficiency.

7. THAT we determined that a larger diameter column would actually be disadvantageous for our application and conceived and developed a secondary column to effect efficient abatement. We conducted testing to show the efficiency of the smaller diameter column and included testing in two different secondary columns, wherein both columns were of the same height but one column had a diameter twice that of the other column. The parameters of the testing regime and results are set forth below.

Test Conditions - A **(SMALLEST DIAMETER COLUMN)**
(i) 0.5 GPM Make-up Water
(ii) 5 slpm NH_3
(iii) 300 slpm N_2
(iv) 18" Tall column
(v) 1" Jaeger Tri-Pack media
(vi) 4" Column Diameter
(vii) Efficiency = 95.9%
(viii)Outlet NH_3 concentration = 678.9ppm

INCREASING LARGER COLUMN DIAMETER

Test Conditions -B
0.5 GPM Make-up Water
(i) 5 slpm NH_3
(ii) 300 slpm N_2
(iii) 18" Tall column
(iv) 1" Jaeger Tri-Pack media
(v) 8" Column Diameter
(vi) Efficiency = 84.6%
(vii) Outlet NH_3 concentration = 2528ppm

Test Conditions - C
(i) 0.5 GPM make-up water
(ii) 5 slpm NH3
(iii) 300 slpm N2

(iv) 18" tall column
(v) 1" Jaeger Tri-pack media
(vi) **12" diameter column**
(vii) Efficiency = 72.4%
(viii) Outlet concentration = 4530 ppm

Test Conditions - D
(i) 0.5 GPM make-up water
(ii) 5 slpm NH3
(iii) 300 slpm N2
(iv) 18" tall column
(v) 1" Jaeger Tri-pack media
(vi) **18" diameter column**
(vii) Efficiency = 58.8%
(viii) Outlet concentration = 6746 ppm

Test Conditions - E
(i) 0.5 GPM make-up water
(ii) 5 slpm NH3
(iii) 300 slpm N2
(iv) 18" tall column
(v) 1" Jaeger Tri-pack media
(vi) **24" diameter column**
(vii) Efficiency = 49.4%
(viii) Outlet concentration = 8296 ppm

Clearly, the results are unexpected and show that as the column diameter increases there is a decrease in efficiency. Furthermore, as the column diameter increases, additional amounts of water must be used to remove contaminants to an acceptable level. There are very strict limits on the amount of fresh water that can be used in the semiconductor industry and most users of scrubbing systems expect that fresh make-up water be equal to or less than 1 GPM, and usually they would prefer to be in the 1/3rd GPM - 1/2 GPM range. Thus the larger the secondary scrubber, the more water is required and maintaining low water usage becomes increasing more difficult.

Furthermore, if a larger column is used, one has to include the use of either (a) recirculated water (bad because scrubbing efficiency is limited due to vapor pressure of contaminant, plus is more expensive due to size and requirement for a pump) or (b) add chemical additives (bad because of chemical additive cost, pump cost, control scheme cost, etc.) both of which are used in the prior art but found not acceptable by the semiconductor industry. Clearly, we have found and shown that by using a secondary scrubbing column that is smaller than the primary column there is unexpected abatement efficiency and reduction of total water usage while effecting superior contaminant removal efficiency.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that

these statements are made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statement may jeopardize the validity of the application or any patent issued thereon.

Joseph D. Sweeney